

**CLAIMS**

1. A sonochemical reactor comprising a reaction chamber having a plurality of externally mounted transducers physically coupled thereto, the transducers being spaced apart along a longitudinal axis of the chamber and in which the transducers are operable to excite the reaction chamber walls in a breathing mode.
2. A sonochemical reactor according to Claim 1 in which cavitation is induced within the reaction chamber predominantly in a central region remote from the reaction chamber wall.
3. A reactor as claimed in Claim 1, in which each said transducer is a ring transducer.
4. A reactor as claimed in Claim 2, in which the transducer is radially poled.
5. A reactor as claimed in Claim 2 in which the transducer is tangentially poled.
6. A reactor as claimed in any one of Claims 1 to 3, in which the transducers are spaced apart by a distance of substantially one quarter or less of the wavelength of their excitation frequency.
7. A reactor as claimed in any preceding Claim, in which each transducer lies substantially within a respective plane orthogonal to said longitudinal axis.
8. A reactor as claimed in any preceding Claim, in which the reaction chamber is a thin-walled right circular cylinder.
9. A reactor as claimed in any preceding Claim, in which the reaction chamber is oil-cooled.
10. A reactor according to any preceding claim in which the transducers are driven in phase with each other.

- 5 11. A reactor according to any preceding claim further comprising a sleeve disposed around the reaction chamber, the transducers being mounted on an outer face of the sleeve and the volume between the sleeve and the reaction chamber containing a first fluid of a viscosity higher than a second fluid around the transducers.
12. A reactor according to claim 11 in which the first fluid is oil.
- 10 13. A reactor according to any one of claims 11-12 in which the second fluid is air.
14. A reactor according to any one of claims 11-13 in which one or more of the first and second fluids is circulated to provide a cooling effect.
- 15 15. A reactor as claimed in any preceding Claim, in which a separate inlet and outlet is provided to the reaction chamber.
16. A controller for a reactor as claimed in any one of claims 1-15, the controller being arranged to operate the transducers in a breathing mode.
- 20 17. A sonochemical processing system including at least one reactor as claimed in any preceding Claim, the system further including a holding tank connected to an inlet of said reactor and a collection tank connected to said outlet.
- 25 18. A system as claimed in Claim 17, further including a manifold connecting said holding tank to a plurality of reactors.
19. A method of insonifying a fluid, the method comprising the steps of:
- 30 providing a reaction chamber having a plurality of externally mounted transducers physically coupled thereto, the transducers being spaced apart along a longitudinal axis of the chamber;
- locating the fluid in the reaction chamber;
- 35 operating the transducers so as to excite the reaction chamber walls in a breathing mode.

20. A method according to claim 19 in which the fluid is one of waste sludge, industrial effluent, a chemical or pharmaceutical compound, a hydrocarbon, and a food product or component.

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21. A program for a computer for operating sonochemical reactor comprising a reaction chamber having a plurality of externally mounted transducers physically coupled thereto, the transducers being spaced apart along a longitudinal axis of the chamber, the program having code portions arranged to operate the transducers so as to excite the reaction chamber walls in a breathing mode.

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